(Vegetable Product Series, No. 34.)
(Food Substances.)

THE

AGRICULTURAL LEDGER.

1897—No. 4.

MANIHOT UTILISSIMA; ALSO M. PALMATA.

(CASSAVA, TAPIOCA, MANIOC.)

[*DICTIONARY OF ECONOMIC PRODUCTS, Vol. V., M. 216–30.*]

THE TAPIOCA PLANT CONSIDERED AS AN ALTERNATIVE FOOD-STUFF IN SEASONS OF SCARCITY AND FAMINE.

Correspondence between MR. E. HALLIDAY GUNNING, M.D., HON. LL.D., *and* MR. ROBERT THOMSON *and Her Majesty's Secretary of State for India and the Government of India. A Note on Tapioca Cultivation in Travancore, by* MR. A. M. SAWYER, *(reprinted from 'The Indian Forester,' Vol. XXI., pp. 290—296). Introductory remarks by* THE EDITOR.

CALCUTTA:
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The papers reproduced in the following pages on the subject of Manioc or **Manihot** (Tapioca plant) are of special interest at the present time.

Cultivation: Bengal.

During the writer's recent tour through Dinajpur, Rangpur, Bogra, and Jalpaiguri Districts of North Bengal, as also Kamrup, Nowgong, and Sibsagar Districts of Assam, he devoted some attention to the study of the Tapioca plant. He found it being cultivated under the name of *simla-alu* or *simul-alu* (that is to say, the potato from the plant that resembles **Bombax malabaricum**).

Assam.

In Assam it is not, strictly speaking, cultivated, but is used as a hedge plant, the roots being dug up and eaten as required.

As practised in Bengal.

In the districts of Bengal mentioned above there is a more or less regular cultivation. The plant is propagated by stem-cuttings. When the crop is harvested in October the stems are collected and stored in the shade. In May or June, as soon as the rains begin, these are cut up into lengths of nine to twelve inches, and planted out two yards apart. They each give 3 to 4 seers of tubers in

Yield.

October to November. The yield per acre is therefore very large and the crop gives very little trouble.

Travancore.

Conf., pp. 13 et seq.

Recommended as a hedge plant and alternative food-stuff.

It may be added in this connection that in Travancore it is largely grown and tapioca is said to be made from it as a regular article of trade.

Its use as a hedge plant—the roots to be resorted to during periods of distress—seems worthy of consideration, especially for Chutia Nagpur and the districts of the Central Provinces that often suffer from scarcity of food-supply. A more extended effort to cultivate the plant would appear, however, to be undesirable, since in most parts of India the people are averse to eating Tapioca.—*Editor.*

Despatch from Her Majesty's Secretary of State for India, to the Government of India, No. 12 (Revenue), dated the 21st January 1897.

Conf. p. 11.

I forward herewith, for the information of your Excellency's Government, a copy of correspondence with Mr. R. Halliday Gunning, M.D., Honorary LL.D., on the subject of the introduction into India of the Manioc or Mandioca (Tapioca plants) of South America as an alternative food-crop in times of prolonged drought and famine. Both the Bitter and the Sweet Cassava plants are well known throughout India, and the Bitter Cassava is cultivated for food in Assam. It might be found advantageous to extend its cultivation, and that of the Sweet Cassava, to other parts of the Indian Empire, as a reserve resource in times of apprehended famine.

Dated London, the 26th December 1896.

From—R. H. GUNNING, Esq., M.D., Hon. LL.D.,

To—The Secretary of State for India.

Impressed, when residing in Brazil, by the gigantic mortality and expense resulting from famines in India, and then believing, as I still believe, that the planting of Manioc (called in Brazil Mandioca) would be an effective means of preventing or mitigating such famines, I brought the subject before the late Sir George Buckley Mathew, Her Majesty's Minister at Rio de Janeiro, and my ideas being highly approved by him and other Foreign Ministers and by the local press, I was advised to write to the late Lord Derby, who was then (in 1874) Minister for Foreign Affairs, and His Lordship sent my letter to the India Office, then held by Lord Salisbury. I think my scheme was understood as a wish to introduce Manioc as a substitute for rice, whereas my object was only to introduce it as an alternative food, or precaution against famine in times of prolonged drought. Somehow the subject was allowed to drop, but the present visitation of famine being so serious (see cuttings enclosed from to-day's *Times*), and other famines being likely to recur, I have thought it my duty to draw public attention to it, and in this view I asked the advice

and help of my kind friend Lord Lorne, as you will see by the enclosed correspondence. I am blind and in indifferent health, and in my 79th year, but I should like very much if your Lordship will study the subject, as I feel convinced that the introduction of this God-ordained food for drought and famine into many parts of India out of communication with railways would save millions of pounds and millions of lives. Livingstone, calls it "the staff of life" in Africa, and it is a universal food in Brazil, Chili, Peru, and Central America, in all of which countries we never hear of famines, though there are often very long droughts, and there is no reason that I know of why it should not be planted in every locality in India where needed.

My scheme can be of no use for the present famine, but the plant could be introduced by millions in a few years. In the first year the roots can be availed of for food, and the stems and branches (each plant giving fully 100 slips) can be handed on to fresh planters, so that within a few years all the countries most needing it could be supplied. The expense of getting branches from some parts of India, Africa, or Brazil would only be the expense of the carriage, as the branches are only used as firewood when the food-roots are taken away. The Manioc I am speaking of now is not the poisonous but the sweet kind,—the **Manihot utilissima**,—and I shall be happy to have some boxes of cuttings from the best varieties in Brazil sent to the British Consul at Rio de Janeiro for transport to India. I sent some specimens to the Royal Botanical Society, and I could show the root and plant to anyone your Lordship might appoint to investigate the matter. I am leaving town for Torquay on January 9th, but till that date I shall be happy to wait on your Lordship, or anyone you may appoint, to make further explanations.

Dated Palmeiras, Brazil, the 13th September 1874.

From—R. H. GUNNING, Esq., M.A., M.D., etc.,

To—The Right Honourable the EARL OF DERBY, D.C.L., Her Britannic Majesty's Secretary of State for Foreign Affairs, Foreign Office, London.

The severity of the famine in India has been alleviated as only a wealthy, energetic, and Christian nation like England could do, but at what a sacrifice of wealth and energy to England, and with what misery of mind and body to millions of her subjects in India. Besides plans of irrigation, and facility of supply from other localities by railroads and canals, what other auxiliaries are there? One occurs to the writer, and, deeming it of great importance, he feels it a duty to bring it under your Lordship's notice. He does it the more easily that your Lordship's interest in the progress and wellbeing of India is well known and, not less, your Lordship's wide information and sound judgment as a philosophical and practical statesman. Thus interested in our Eastern Empire, and thus mentally qualified, my ideas and argument will be better appreciated.

MANIHOT utilissima. **The Tapioca Plant considered as an alternative**

The principal food in India being rice, and rice depending on rains, what when these rains fail? My idea, my suggestion is, for every planter or landholder to have at hand the Cassava or Mandioca plant, the root of which is of the same nature as rice, as delicious as the potato, and keeps fresh underground for years, indifferent to great changes of heat or cold. It is a universal article of food in Brazil, being used from north to south, and east to west, in the whole Empire. Tirhoot is in latitude north what Santa Catherina (a great field for Cassava) is south, but Mandioca conforms to a great diversity of climate, season, and soil. It is easily got, planted, cultivated, and gives an immense return—six times greater than wheat, according to some! It can be grown easily, seeing it is a large branchy arbuscle, and the numerous knots or leaf-marks on the branches are each a new plant. In cutting the branches to plant, the slips are made about three inches long, and include two or three of these knots, and yet each plant will give from, say, twenty to sixty separate slips, and therefore as many new plants. Once started with a good number of plants, the roots of which can be availed of in eight to twelve months, few years would be required to distribute it over whole territories the first holders merely keeping a few branches to replant and handing over the rest to neighbours; for unless to plant, they are of little value except as firewood. Then it carries easily, as being succulent the branches will keep alive two or three months with little care. It has been introduced into the West Indies and Africa—why not into India, in these times of fleet steamships and direct routes? Boxes of plants could be sent from Brazil, or perhaps Mandioca may be had in Portuguese India, the Cape of Good Hope, or somewhere nearer than Brazil. The planting is very simple, and may be done in any soil, but a soft or sandy soil suits best, the tuberous root developing more easily when there is little bind in the soil. Once the surface of the ground is cleaned by a broad hoe, slight notches two or three inches deep are to be made a yard or two apart, and the cutting laid in and lightly covered. If the soil is deep or sandy, it may be raised into little heaps or ridges, and the slips then placed in the same way. The planting can be done during the whole year, but the best time is when the cold season is ended, when the leaves have fallen and when it is quite ripe. Soon the pretty five-partite leaves show above ground, and all the further cultivation needed is to weed or hoe round it (pulling the earth against the plant) twice or thrice during nine months, when the plant will have flowered and the roots will be ready to eat. But they are larger and more mealy when twelve months old, and keep growing for two years longer. There are two varieties or species of Mandioca, one with a sweet root (Manihot Aipi), the other bitter* (Janipha Manihot) and poisonous from containing prussic acid in its juice. But with this juice pressed out or dissipated by heat, it is innocuous. To common observation they seem

* Now **Manihot utilissima**.—*Ed.*

alike, but it is easy to see the difference on looking closer. In the poisonous kind the leaves and summits of the branches are darker, and the roots have a purple hue under the cuticle which is wanting in the sweet kind. But the easy test is to taste the broken root. One is sweet like almonds, the other bitter and repulsive. Better only to introduce the sweet at first, in view of its being used quickly and extensively as the potato. Afterwards, and where mills can be erected, the bitter kind could also be cultivated. It is said the bitter yields more than the sweet, but I have not observed it so. I know no reason for growing the bitter, except for better repelling attacks of insects, cattle, etc. Both grow well here, but the bitter is safer against appropriation by bad neighbours or their cattle. Each plant gives from three to six long thick roots, weighing conjointly from half a stone upwards, and covered with a brown coarse skin. This thick skin being peeled off, the rest can be boiled entire, or if large, it can be cut up like the potato or it can be roasted in the ashes. It is nice and delicate prepared in any of these ways, and in Brazil is relished by rich and poor even more than rice. In any case, if not always a luxury, every one would find it so in times of starvation. Enough at first to have it propagated among the poor, to be ready in seasons precarious to rice. A small garden or spot of ground will grow enough for a family. Surplus branches are always abundant, and they will grow in any ground. Women or children can easily attend to the plants, and the roots need no storage, as they keep fresh and even increase in the ground. I should think that all would be glad to have Mandioca, not only as a preventive of famine, but as a variety or change from rice. Rice and Mandioca are the same in composition. Both have a large preponderance of amylaceous matter and little gluten or flesh-forming element, but for this reason they suit the climate and habits and render the body less liable to diarrhœa, dysentery, etc. The great object, I repeat, should be to have it spread rapidly over different districts, as a good root to be used as potato, but afterwards its other uses may be availed of.

The peeled root is grated on a common grater, by a handwheel, or by one driven by machinery, into a soft pulp, and this, after the water is pressed out, heated in copper pans, is the farina of universal use. From this can be made tapioca, and a nice starch known here as "polvilho" and in England as Brazilian arrowroot. The dry farina is used alone or with many dishes. The *rationale* is, it necessitates and stimulates saliva and thus assists digestion. Made into a paste with boiling water, it is used with fish, or fried in little cakes. It keeps in bags for a long time without souring, and so can be carried from one district to another in the usual way of commerce. The juice of the bitter kind is made in the West Indies into the famous and much-prized "Casareep" or "Cassiripe," and fermented it gives a vinous spirit.

In fine, the idea is not to substitute the cultivation of rice and the habits of the people, but that they should have a variety of the same kind of food as rice, and one fitted to endure in droughts when cereals fail.

MANIHOT utilissima. **The Tapioca Plant considered as an alternative**

The Quina plant has been acclimatised and successfully introduced into India for a long time. A few years ago I had the honour to send plants of Ipecacuanha to Sir Robert Christison and Professor Balfour of Edinburgh University, to have it propagated in India, for the treatment of dysentery, as the supply from Brazil was getting precarious. Both have a wide application and significance in a country where intermittents and dysentery abound, but much more significant and much more beneficial and economical will be the wide introduction of Mandioca, seeing that millions of human beings and millions of pounds sterling are involved in the misery of a famine.

If my suggestion is useful, and if I can be of any use in carrying it out, my services are at your Lordship's orders, and I shall be highly rewarded if it should tend to prevent, or even to alleviate, the misery of future famines.

Since writing the above, my attention has been drawn to references to Mandioca in *Livingstone's Travels*. In the 17th and 21st chapters he alludes to it in terms which confirm my ideas, and are fitted to encourage your Lordship's attention to the subject. He speaks of it as having been introduced by Portuguese missionaries and traders. In chapter 17 he says: "Every valley has gardens of Mandioca, which here is looked upon as the staff of life. Very little labour is required for its cultivation," etc. He is speaking of the bitter kind badly prepared. In chapter 21—"they subsist chiefly on the Manioc, raw, roasted, or boiled. It bears drought well, never shrivelling like other plants when deprived of rain, never eaten by weevils, and so little labour is required for its cultivation that it is commonly sold in Angola for one penny for ten pounds."

Dated Foreign Office, London, the 14th October 1874.

From—T. V. LISTER,
To—R. H. GUNNING, Esq., M.D.

I am directed by the Earl of Derby to acknowledge the receipt of your letter of the 13th ultimo, recommending the introduction of the Manioc tree into India, and I am in reply to inform you that His Lordship has referred your communication to the Secretary of State for India.

Dated Foreign Office, London, the 18th November 1874.

From—LORD TENTERDEN,
To—R. H. GUNNING, Esq., M.D.

The Earl of Derby has communicated to the Secretary of State for India in Council your letter which was forwarded to this office by Her Majesty's Minister at Rio de Janeiro, containing a proposal relative to the introduction of the Manioc tree into India as an additional source of food-supply; and I am now directed by His Lordship to express to you the

thanks of the Marquis of Salisbury for your suggestions on this point and for your interesting account of the cultivation of the tree in question.

I am at the same time to state to you that the **Janipha Manihot*** is already largely cultivated in India, and it would not therefore, in the opinion of the Indian Government, be necessary to import plants from Brazil in the event of the cultivation of Cassava being largely extended.

Dated 12, Addison Cresent, Kensington, London W., the 21st December 1896.

From—R. H. GUNNING, Esq., M.D.,

To—LORD LORNE.

I hope you will excuse me for trying to enlist your help and sympathy with my scheme for the prevention of famines in India. I feel confident that it only requires to be known to be adopted by the Indian Government. I wonder that it was not adopted when I suggested it now twenty-two years ago, and I can only explain its non-adoption by believing that my idea was not well understood. You will see, by reading the first paragraph of Lord Derby's second letter (18th November 1874) that I was understood to propose "the introduction of the Mandioca plant into India as an additional source of food-supply," but that was not my whole meaning. I meant it only as an alternative food, which could be used instead of rice during long droughts, and therefore as naturally fitted to prevent famine. This is the point which has been overlooked and should therefore now be attended to. In the third last paragraph of my letter to Lord Derby on the subject of Mandioca, what I said runs thus: "The idea is not to substitute the cultivation of rice and the habits of the people, but that they should have a variety of the same kind of food as rice, and one fitted to endure in droughts when cereals fail." This recommendation is as forcible now as it was then, and I do not believe it possible to gainsay the soundness of the advice, though somehow it has not been carried out.

Having influenced the Brazilian Government to serve Her Majesty's Minister in the question of the great mortality of British immigrants, as you will see by the enclosed letter, we became fast friends, and it was at his instance that I was induced to write to the then Foreign Minister, the late Lord Derby, and, having done so, I left the question alone, and it has lain dormant till now that a great famine is again attracting public attention and demands fresh consideration. The many railways made since then, the great extension of wells and irrigation, and the large employment of hundreds of thousands on public works, will mitigate much suffering and mortality, but there will still remain a great deal not overtaken by such means, but which could be met by Mandioca. My plan cannot serve the present famine, but should be introduced to serve against future droughts.

* *Vide* Note on page 4.

It occurs to me that the subject of my paper might be brought before the Secretary of State for India, who could bring his best advisers to discuss the *pros* and *cons* with me. Or it could be discussed in the Imperial Institute before a select audience of experts connected with India and Africa, who could hear and say all that is necessary for the acceptance or rejection of the scheme. Though old and blind and in indifferent health, I will try to meet any who know the subject, and give them all the information in my power. Men like Stanley, Selous, Bishop Tucker, and others, who know much of Africa, could assist and bear testimony to the thesis that Manioc is God's natural provision against droughts and famine, and is the surest means of saving people when drought destroys rice and other kinds of food. In short, you have position, and talent, and patriotism to take this great national question under your ægis, and I appeal to you to do so in the interests of your Indian Empire.

If you could arrange a meeting of experts, I think I could take a Mandioca plant with its roots to show better what I mean. At least I believe there are some of my plants in the Royal Botanic Gardens. I have to leave London on January 9th, and would take it as a great kindness if you could see me on the subject after reading the accompanying papers.

With much respect and all good Christmas wishes.

Dated Osborne, the 23rd December 1896.

From—LORD LORNE,
To—R. H. GUNNING, Esq., M.D.

The matter of the cultivation of the Manioc would be a very good subject for a paper to be read for you at the Imperial Institute. I shall not be able to attend any meeting in London before January 9th, the date you mention as that of your departure for the south. I am sure that any suggestion addressed by you to Sir F. Abel at the Imperial Institute with regard to the reading of a paper to be contributed by you would receive respectful attention.

Lord George Hamilton would also give you information up to date with regard to the cultivation in India of the Manioc.

Wishing you a very happy Christmas.

Dated Rio de Janeiro, the 9th November 1873.

From—SIR GEORGE BUCKLEY MATHEW,
To—R. H. GUNNING, Esq., M.D., Palmeiras.

I am instructed by Earl Granville to convey to you the special thanks of Her Majesty's Government for the great kindness you have shown towards the British immigrants to Brazil.

Permit me in fulfilling this pleasing duty to add my sincere acknowledgments for the great trouble you have taken in bghalf of these ill-used and indigent people.

No. 444, dated 8th March 1875.

From—The Secretary to the Government of the North-Western Provinces,

To—The Secretary to the Government of India, Department of Revenue, Agriculture, and Commerce.

In reply to your letter No. 1386, dated the 30th December last, I am directed to submit, for the information of His Excellency the Governor General in Council, a report* by the Superintendent of the Botanical Gardens, Saharanpur, on the cultivation of the Tapioca or Manioc tree in India.

* No. 256, dated the 18th February last.

No. 256, dated 18th February 1875.

From—The Superintendent, Botanical Gardens, North-Western Provinces, Saharanpur,

To—The Secretary to the Government of the North-Western Provinces.

I have the honour to acknowlege the receipt of your docket No. 120 A., dated the 16th ultimo, with enclosures, regarding the cultivation of the Tapioca or Manioc bearing tree, and recommending its introduction into India as a food-affording stuff in times of scarcity or famine. Nowhere in the North-Western Provinces has the Tapioca plant **Janipha Manihot** or **Manihot utilissima** been cultivated for its Tapioca or Cassava which is known under the names of Mandioca Farenha or Farine de Manioc, and both of which are prepared from the Janipha roots, of which there are two varieties, the bitter and the sweet. The tapioca is prepared by rough scrapers which grind the tubers to powder; the starch is then washed out of the pulp and dried upon hot plates and kept stirred by iron rods, which break up the pasty mass, and give, in drying, the very irregular rocky appearance peculiar to tapioca. In making Cassava the starch is not washed from the pulp, but the pulp is dried upon hot metal plates, and afterwards roughly powdered. This rough powder, according to its fineness, is designated by the names above given. Tapioca used to be extensively grown at Alipore, Calcutta, by Messrs. Speede, where now the arrowroot produced is of high repute. That the cultivation of the Janipha is still continued I am not aware. Into the Bombay Presidency the Tapioca plant has been introduced in many localities. What kinds have been introduced—the sweet or the bitter Cassava—is not mentioned, but probably both. The bitter is poisonous, but the poisonous principle is easily dissipated by washing the grated powder or by heat. But in the Dekkan the size of the root is not such as to compete with the Potato

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or Sweet Potato. In Eastern Africa it is cultivated very largely, and in the Island of Zanzibar or the west coast in Congo and Guinea, it is also abundantly cultivated. From Brazil it has also been introduced into the Mauritius, Madagascar, and Ceylon. It also now grows abundantly in most of the West India islands. For the North-Western Provinces the plant is not adapted, as it is liable to be injured by frost. I have already pointed out that it has been extensively cultivated in the neighbourhood of Calcutta, and is well known in the Madras* and Bombay Presidencies. If, therefore, it be deemed necessary to try its cultivation on a large and useful scale, there will be no difficulty in procuring plants, and it ought to be carried out in the Bengal, Madras, or Bombay Presidency.

The observations of Dr. Gunning regarding its introduction into India are interesting. But the above remarks show that the Cassava or Mandioc yielding plant (**Manihot utilissima**) is already well known, and its cultivation not carried on on an extensive scale because it does not pay. That it will grow in dry places is worthy of attention and experiment as the root in times of scarcity might be usefully employed as food by the poorer classes.

No. 14 G., dated 4th March 1875.

From—The Superintendent, Royal Botanical Garden, Seebpur, Calcutta.

To—The Assistant Secretary to the Government of Bengal.

I have the honour to acknowledge receipt of your endorsement No. 69, Financial Department, Agriculture, dated 7th January, giving cover to certain original papers (herewith returned enclosed) concerning the cultivation of the Manioc or Manihot plant in India.

2. In reply, I have the honour to state that on enquiry I find that the plant is not grown in the North-Western Provinces, Oudh, Punjab, or Central Provinces, except occasionally as a curiosity in gardens. In Bengal gardens it is more frequently met with, and still more frequently so in Burma.

3. It has in no part of Continental India been much appreciated by natives. The natural acridity of the part used, prior to manipulation, is much against its introduction as a staple food. The plant is, moreover, one which requires a good supply of water, and would fail as a food-crop in seasons when rice also fails from that cause. It could not, therefore, be trusted to as a substitute for rice.

Should it be wished to encourage the cultivation of Manioc in Upper India, I believe it would be unnecessary to import supplies of plants from South America, as enough could be collected in India to form a distribution nursery.

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* Ainslie's Mat. Med., Vol. I, p. 429; Pareira, Mat. Med., Vol. II, Pt. I, p. 428.

Despatch from Her Majesty's Secretary of State for India, to the Government of India,—No. 64 (Revenue), dated the 22nd April 1897.

In continuation of my despatch No. 12 (Revenue) of the 21st January last, relating to the introduction of the Manihot (Tapioca or Cassava) plants of South America into India, I herewith forward, for your Excellency's information, a copy of a letter* on the same subject received from Mr. Robert Thomson of Lan Cayetano, near Bogota, in the Republic of Columbia.

Conf. pp. 2.

* Dated 25th January 1897.

Dated Lan Cayetano, the 25th January 1897.

From—ROBERT THOMSON, Esq.,

To—The Right Honourable the Secretary of State for India.

I have the honour to submit, for your Lordship's information, the following remarks relative to an important food-yielding plant cultivated in this country, it having occurred to me that the cultivation of this plant on a large scale in India would, in all probability, mitigate the calamitous effects of famine.

This plant, **Manihot utilissima**, is cultivated extensively in South American countries. It is also generally dispersed throughout the West India islands. In Jamaica and other islands two or three varieties of this plant are cultivated to a limited extent for the production of starch and farina from the tubers. One of these varieties cultivated in the West Indies is noxious. In Jamaica the plant is called cassava, in Colombia yuca, in Brazil manihot or mandioc.

In reference to this plant the *Ceylon Directory* for 1891-92, says:—

"The check put by the Ceylon Government on the wasteful system of 'chena' cultivation—the sowing of grain on burnt-off forest land—has induced a good many of the Sinhalese to turn their attention to the cultivation of cassava, an article which might be made as widely useful for feeding human beings and cattle in Ceylon as it is in Brazil. . . Cassava is one of the principal articles of food in tropical America, the equivalent of the potato in temperate regions. It was probably introduced into Ceylon by the Portuguese, but never much cultivated till of recent years. . . . Bennett in his 'Ceylon and its Capabilities' takes credit for being the first, about 1820, to introduce 'the sweet cassava' or mandioc into Ceylon, which he considers the root most fitted to be a substitute for rice, but he complains that very little was done by the natives to cultivate it generally, although so easily accomplished, and the produce so nutritious."

It is not quite clear whether the tuber itself is consumed as an article of food in Ceylon, or whether, as in Jamaica, it is employed exclusively for the extraction of farina and starch. Anyhow it would appear that the

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peculiar merit of this plant bespeaks for it an important position among the cultural products of India. This merit, presumably, is not known in the East, and it is not adequately appreciated in Columbia nor throughout South America.

In Columbia, as well as in other South American countries, the large tubers are extensively consumed as an article of food. In this country, too, it is noteworthy that some twenty varieties are known in cultivation, some growing in rich soil and some in exhausted or impoverished soil. As an article of food the tubers of several varieties are highly esteemed, commonly esteemed, when quite fresh, in preference to potatoes, which, it may be mentioned, are largely cultivated on the uplands. To these advantages, and they are considerable, another may be added, that is, in Columbia manihot or yuca grows from the level of the sea up to full 6,000 feet. Hence it may be cultivated over a considerable range of latitude. But its peculiar, and most commendable, merit consists in its capacity to flourish in regions not only where prolonged droughts are experienced, but also in comparatively desert regions. Hence it would be a precious adjunct to rice cultivation.

In a recent article in *The Times* of London relative to the impending famine reference is made to a document issued by the Bengal Department of Land Records and Agriculture, which shows that during last June the rainfall, on which the starting of the winter rice crop depends, was abundant in certain districts of Bengal and deficient in others. "Throughout July, August and the first fortnight of September the rainfall was insufficient for the requirements of the winter rice crop in most parts of Bengal."

Touching manihot or yuca I may here observe that its constitutional flexibility enables it to withstand conditions of drought incomparably less favourable than those indicated for rice. Furthermore, I may state that there is no other important food-plant capable of thriving side by side with manihot in districts defaced by disastrous droughts. Thus, where all surrounding vegetation is scorched by tropical drought, where cattle and other animals, roaming over a wide expanse, are reduced to dreadful straits and perishing, this plant maintains its irrepressible vigour.

In this connection it is interesting to note that an important rubber-yielding tree, introduced to India by Sir Clements R. Markham the Ceara rubber of commerce, **Manihot Glaziovii**, is a species of this food-yielding plant. As is well known this rubber tree luxuriates in decidedly arid regions.

Manihot or yuca is propagated with remarkable facility : small pieces of the stem are set in the ground, thus to form the plantation. It attains a height of from three to five feet. On the hot plains crops are secured in eight months ; on the uplands from 4,000 to 6,000 feet, in from ten to twelve months. The entire crop is not obtained at a single digging, and this is an advantage where severe droughts are experienced, but

intermittently as the tubers arrive at maturity; thus the cropping season is spread over several months. The market price of tubers in Columbia when abundant, is, in English money-value, half-a-crown per quintal. Doubtless the tubers could be produced in India for one-third of this sum. The labour required to produce this article stands at *a minimum*. Potatoes here cost three times more than manihot tubers. Under very favourable circumstances one arroba (25 lb.) is obtained from a single plant. But allowing an average of five pounds per plant ten tons per acre would result—they are planted a yard apart.

In a report of mine presented to both Houses of Parliament twenty years ago, "the Products of Jamaica at the Philadelphia International Exhibition, 1876," in reference to farina or "meal" from manihot (cassava), I stated that the plant grows best in dry localities, and that under high cultivation twenty tons of tubers were obtainable per acre.

In conclusion, it may be mentioned that there is some ground for believing that when this plant acquires importance in India as an adjunct to rice, the following passage from a recent issue of *The Times* on the subject of famine in India shall be no longer valid:—"But if the rain will not fall the land cannot be cultivated and agricultural labour of every sort ceases. Then comes the sudden outburst of despair, when, as in 1866, hundreds of thousands of men and women and starving children fly from their homes in the vague hope of relief elsewhere. In India a population on the drift is a population doomed."

TAPIOCA CULTIVATION IN TRAVANCORE.

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Note by Mr. A. M. SAWYER, *reprinted from 'The Indian Forester,' Vol. XXI., pages 290—296.*

Introduced by the Portuguese in their early settlement at Goa, about the commencement of the sixteenth century, the Bitter Cassava or Manioc, familiarly known as the Tapioca, has been cultivated on the West Coast ever since. But nowhere, perhaps, on that undulating, palm-fringed seaboard has it thriven so well as within the flowery dominions of His Highness the Maharajah of Travancore, where the soil and climate are variable and equable enough to suit it as well as many another tropical South American species like itself. With an abundant rainfall, a gorgeous and invigorating sunshine, and a perennial dew, evergreen species, indigenous and introduced, many and varied, live and thrive. Under these conditions, that a hardy EUPHORBIA like the Tapioca, indifferent to soil and unmindful of all but extremes of climate, should, when brought under the rude cultivation of the Malayali peasantry, cover extensive areas of both hill and dale, must pass without exception.

Towards the middle of October or the beginning of November, when the north-east monsoon is usually at its height, suitable areas, often

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several acres in extent, are selected for cultivation. The soil being then soft, moist, and easily worked, is either then deeply hoed or ploughed over, and the surface laid out in mounds or platforms each from two to three feet square, and about a foot high. Sometimes circular or rectangular patches, a yard in diameter, are prepared. The platforms and patches are, in some localities, dressed with ashes, leaves, or cattle-droppings, but they are, especially in free, loamy soils, usually let alone. A sufficient number of stems for stocking the area are selected from the previous year's growth, which is either still standing or but recently removed. Each stem is cut up into several little bits varying from six to eight inches in length, care being taken to, in so doing, secure for the plantation only the lower and more mature portions of the stems. Should there be too much rain, the cuttings are kept under cover until a favourable break in the weather occurs; for, if put out in water-gorged soil, they are liable to decay. It is also for this reason that the Malayali selects a well-drained locality—usually a hill-side. But if it be only showery weather and the area well drained, the cuttings are put into the beds directly they are prepared. A bed or patch is considered fully stocked if it hold two or three cuttings which are put down each at a slant of about 60 degrees, and buried in the soil for nearly two thirds of their length. Varying from ten days to a fortnight of their being put out, the cuttings strike root, and the young shoots come up vigorously in light-green tufts of pretty palmate leaves. It is interesting to note that the earliest leaves are usually small, and either three or five lobed, but these are soon supplanted by larger and seven-lobed ones arranged on the stems in a close, alternate phyllotaxis. While the leaves are emerging in all directions over the gradually elongating, wand-like stem, the numerous roots, white and thread-like, radiate from its base into the cultivated area around. In a month or two after the cuttings are put out, the lateral development of their roots begins, and in another eight or ten months they will, in average soil and under ordinary cultivations, have sufficiently developed to be dug up for use. But, as a rule, the roots are allowed to remain in the soil for two months more, in order that the cultivator may, by falling in with the ensuing wet season, secure for the future crop the best results. The rotation of the crops is thus maintained in an uninterrupted annual cycle fixed by the monsoon rains. But should the rains be late and the market favourable, the Tapioca is dug up as soon as it matures, and, as this would be towards the end of the hot season, the new plantation is started at once, but copiously watered once every three or four days until the rains are fairly on. It is said that, so far from interfering with the normal growth and development of the Tapioca, this hot-weather cultivation yields good enough results to quite repay the extra labour it entails. Indeed, the scarcity of water towards the close of the hot weather alone prevents the practice being more largely adopted. Again, a peculiar race of the Tapioca, which is cultivated here, yields two crops in the year; the first of these is, at the end of six months, harvested

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in March, one of the hottest months of the year. As the stems cannot be kept for any length of time without drying, the plantation of the ensuing season is started forthwith, the cuttings being watered until the April showers begin, after which the young plants are left to themselves. The hot weather, though short, is sometimes, and especially of late, very oppressive; but the plants rarely fail, except in extremely stony or sandy soils, and it is the experience of the Malayali that the roots produced by these hot-weather plants are more wholesome and delicious than those yielded by the previous cool-weather ones.

The yield of Tapioca varies with the soil, the amount of care bestowed on its cultivation, the nature and quantity of the manure used, the rainfall, and the particular race or variety cultivated. Although it grows on almost any soil—from stony laterite through gravel to sand and even clay—it thrives best on a well-drained, soft, sandy loam, with an admixture of humus. Stony soil interferes with both quantity and kind, gravel tends to contort the roots often to such a degree as to unfavourably influence their appearance and market value, while clayey soils, always cold, prevent their developing to normal dimensions. Again, the larger the quantity of manure used, the better the yield and the more farinaceous the roots. Ashes or ashes and leaves give the best results, while cow-dung or other cattle-droppings frequently only injuriously affect the quality, though they improve the quantity, of the roots of the more nauseous varieties.

A well-grown healthy root is generally about two feet long, three inches in diameter, and between six and eight pounds in weight. It is generally a little thicker at the attached end, and tapers gradually to a more or less fine point at the free end. The usual colour of the thin outer skin of the root is a pale brown, a stout, tough, white sheath of inner skin closely investing the delicate substance of the root itself. On breaking across it, this brittle substance, turgescent with milky farina, is seen to intimately adhere to and lie around a compact vein of dense fibrous tissue that runs through the centre of the root for its entire length. This vein is probably the original thread-like fibre around which the farinaceous substance is subsequently developed. The root contains the greatest quantity of farinaceous material in from ten to fifteen months after the cuttings are put out, but if allowed to remain in the soil after that time, it soon grows woody, and ere long deteriorates into a soft, spongy mass, the tough fibrous core at the centre being replaced by a narrow canal containing pulpy decaying fluid of grey cellular matter. It is also interesting that, under ordinary conditions, the Tapioca root seldom bifurcates or divides in any way, and that even root-fibres are few and far between; so that absorption of the requisite substances from the soil takes place chiefly through the epithelium of the root itself.

The cultivation of the Tapioca by the hill-men of Travancore is even ruder than that pursued by their more enlightened brethren of the low

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country. Every year, towards the close of the hot season, extensive patches of forest are cut down and burnt; and, as soon as the monsoon rains have descended, different kinds of paddy, *ragi*, maize and Indian-corn, chilies, *dal*, and other seeds and cereals, are sown broadcast and hoed into the soil. Tapioca sticks, too, are put down here and there over the area, and what with the wood-ashes, the humic accumulations of years and the grateful showers, a motley assemblage of plants soon covers the clearing. Each grain is harvested as it matures, and, in due season, the Tapioca, too, is pulled up. Directly they are taken up, the roots are washed, peeled, and cut up into little irregular pieces which are strewn over mats made of the large Esta reed (**Beesha travancorica**) or, what is more usual, upon the bare outcrops of sheet-rock so common on the higher hills; and the sun soon hardens them into the flinty white chips familiarly known as *kani marachini* ("the hill-man's woody potato"). As a rule, the hill-men cultivate just enough grain and Tapioca to meet their requirements for six months of the year, precariously subsisting for the remaining months on wild yams, bulbs and roots. The more forward among them, however, who shrink less from their cultured congeners of the low country, frequently barter some of their produce in exchange for salt, knives, cloths, and other necessaries and luxuries of life. When this is done it is that their excellent Tapioca finds its way to us. This hill-tapioca is much prized by the poorer inhabitants of the outlying towns and villages, because it is believed that the varieties cultivated by the hill-men are generally harmless, and that, for the rest, any nauseous or bitter principle that may remain is efficiently removed by the thorough drying which the roots undergo.

The various processes adopted for removing the poisonous principle of the root, which is now admitted to be some form of hydrocyanic acid, are interesting. Certain varieties, which under the name of the Avians or Boilables are considered harmless, are eaten plain, or made into curry after a single boiling. They are also frequently roasted and eaten with fish curry. The more poisonous kinds are boiled several times, the water being strained off after each boiling. When this process is adopted, the root, after each boiling, is tested; should it taste sweet, it is boiled again, and this is repeated until the peculiar sweetish flavour disappears. An extremely nauseous variety known as the "White Tapioca" has to be boiled at least seven times before it becomes fit for food! Again, the roots of certain other varieties are cut up transversely into thin circular or oval slices, which are dried and then boiled. Frequently the slices are boiled several times and then dried; but when so constantly boiled, the Tapioca, on coming to be cooked, is tough and insipid to the taste and certainly less nourishing. Should the bitter kinds be insufficiently boiled before they are used, violent vomiting, attended with severe pain over the region of the throat and stomach, ensues, the victim grows drowsy, and general prostration and collapse soon follow. The same symptoms are produced by drinking the water in which the roots are boiled. When

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eaten with sugar, jaggery, or molasses, the nausea is very pronounced, and the comatose condition sets in sooner; on the other hand, cocoanut cocoanut-oil, curds and tamarind juice act as vigorous and grateful antidotes, while a solution of assafœtida in water is given to goats and other cattle that are frequently poisoned by eating the leaves of the more nauseous varieties.

Under the local names of *Marachini* (Woody Potato) or *Kappa Kelangu* (Ship Potato), about seventeen commonly recognised varieties of the Tapioca are cultivated in Travancore. But these are evidently only races descended from a few distinct varieties and differentiated through long and peculiar forms of cultivation, not to speak of the powerful influences of soil and climate. These races, proportionate to the bitter principle they contain, may be conveniently brought under one or other of two heads—the Avians or Boilables and the Maravans or dark races. For purposes of study, the following classification has accordingly been found useful:—

1.—*The Avians or easily boilable kinds*, characterised by little bitter principle:—

(*a*) *Pacha Avian* (green boilable).—Leaf-stalks pink along their upper surfaces, but green beneath and at their origin with the blade and insertion at the stem; stems 2 inches in diameter, light green; average height 12 feet; flowers rare; roots pale red, large; average weight 15lbs. each; mature after one year.

(*b*) *Cheenee Avian* (Potato boilable).—Leaf-stalks and stems pale yellow; stems delicate, usual height 5 feet; flowers after one year; roots white, and, like the **Ipomea Batatas** (Sweet Potato) mature in six months after the cuttings are put out; they start in delicate strands from the base of the stem, and develop a few inches beyond it; average weight 10lbs. each. This is also called Vellary Avian (White boilable).

(*c*) *Chovalay Avian* (Red boilable).—Leaf-stalks and stems light red; flowers common; roots small, light red, firmly attached to the stems; mature in one year; average weight 10lbs. each.

(*d*) *Curry Avian* (the Curry boilable).—Leaf-stalks and stems pale pink; delicate plants; usual height 4 feet; flowers common; roots light red, large; average weight 12lbs. each; mature after one year; mealy and wholesome.

(*e*) *Chánì Avian* (the Cow-dung boilable).—So called from the manure usually used in its cultivation. Leaf-stalks pale but red at extremities; stems red, usual height 8 feet; roots few, substance of root arranged in two zones—the outer firm and farinaceous, the inner soft, pulpy, and unfit for food; average weight 8lbs. each.

MANIHOT utilissima. **The Tapioca Plant considered as an alternative**

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(*f*) *Chenkomban* (the Red-stemmed).—A variety resembling the Cheenee Avian, but with the leaf-stalks and stems a bright scarlet.

(*g*) *Neduvengauden* (the Neduvengaud Tapioca).—So called from the district of that name in Travancore where it was first cultivated. Small race; leaf-stalks and stems pale pink; roots small but numerous; average weight 4lbs. each.

II.—*The Maravans, or dark races,* like the particular dark-skinned class of thieves of that name in the Tinnevelly District. These are all more or less nauseous:—

(*a*) *Olley Karim Maravan* (the Dark Maravan).—Leaf-stalks deep red; stems dark green with purple streaks below the attachment of the leaf-stalks on the stem; plants delicate, flowers rare; roots mature in one year, few, deep brown, slightly nauseous; they are very lightly attached to the stem; average weight 10lbs. each.

(*b*) *Nedvuáli-Kian Karim Maravan* (a race whose roots take as firm possession of soil as the tenacious claws of the Neduvalior Iguana lizard).—A much-branched race with stem and leaf-stalk like Olley Karim Maravan; flowers common; roots few, woody, and have to be boiled twice before the bitter principle is removed.

(*c*) *Ana Maravan* (the Giant Maravan).—Leaf-stalks and stems like those of (*a*) in colour, but the stems are tall, thick, and strong, being usually about 20 feet high; flowers rare; roots very large, average weight from 20 to 25 lbs. each, and take 15 months to mature; very nauseous, requiring to be boiled three times.

(*d*) *Kathelay Marachini* (Kath-elay, *i.e.*, bitter-leaved).—Leaf-stalks like those of (*a*); stems pale yellow streaked with red; flower common; roots small but numerous. The race was at one time largely cultivated, but it is now rare; nauseous like (*c*).

(*e*) *Koota Maravan* (the Dwarf Maravan).—Dwarfed, much-branched race, usually 2 or 2½ feet high; leaf-stalks and stems like those of Kathelay Marachini; roots lightly attached to the stem; very nauseous.

(*f*) *Ellavum Kappa* (Areca-like Potato).—Tall race like the Ana Maravan; stems and leaf-stalks dark red; roots thin and numerous, often 25 to the stem; flowers rare; very nauseous.

(*g*) *Avanakkum Kappa* (the Castor-oil plant-like Potato).—Dwarfed, much-branched race, 4 feet high; leaf-stalks red; stems greenish-ash-coloured; roots few, at most four, small; slightly nauseous.

(*h*) *Vellay Marachini* (the White Tapioca).—Leaf-stalks and stems pale green, tall, delicate, much-branched; usual height 25 feet;

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flowers rare; roots brown, lightly attached to the stems; most poisonous, the bitter principle being eliminated only after at least seven successive boilings; race growing extinct, being sometimes cultivated in North Travancore.

(*i*) *Olaven.*—Delicate, rare; stems small, 3 feet high, branched; flowers common; roots small, few; slightly nauseous.

(*j*) *Kili Vakay* (the Parrot-green Tapioca).—Stems and leaf-stalks bright green; leaves few and far apart; usual height 10 feet; flowers common; roots large, few; average weight 12lbs.; slightly nauseous.

Of these races, the most nauseous, it will be seen, are the *Vellay Marachini* and the *Kathelay*, both which, however, are the oldest cultivated, and are now becoming rare; so that long cultivation has, in their cases done comparatively little towards improving the quality of their roots. When left to themselves, and especially under cover, all these races grow into tall and lanky plants, which in time assume the nature of climbers, many of which are often thirty feet high.

With regard to the position the Tapioca industry occupies in Travancore, it may be said to compare favourably with many another similar industry in that country. Much of it is exported, especially of late, and, judging from the increasingly extensive areas under it, the importance of Tapioca cultivation as a profitable industrial pursuit is coming to be realised every day. The Tapioca has long since established itself as an important and excellent article of diet with the Malayali, and the recent steady rise in price of rice bids fair to make it one of the first staple food-stuffs for him, if it is not that already.

The following correspondence on the subject may be given here:—

From E. C. Chisholm, Esq., Colachel, Madras, to George Watt, Esq., M.B., C.M., C.I.E., Reporter on Economic Products to the Government of India, Calcutta,—dated Colachel, the 24th March 1897.

I will be much obliged if you will kindly inform me whether there are any factories in India for turning out Tapioca flour such as exist in the Straits Settlements. If you can tell me if there is any export of the flour or dried roots I will be much obliged.

To the above the following reply was issued by the Reporter:—

To E. C. Chisholm, Esq., Colachel, Madras,—No. $\frac{684}{151}$, *dated 22nd-23rd April 1897.*

In reply to your letter dated the 24th March last, I have the honour to inform you that inquiries have been instituted regarding the information asked for by you on the subject of Tapioca.

On receipt of replies you will be communicated with again.

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As there is a large industry in Tapioca in Travancore, it would be better however were you to address the Madras Chamber of Commerce for particulars. I may also add that you will find a most instructive paper on Tapioca in Travancore in *The Indian Forester*, Vol. XXI., pages 290—296.

At the same time the following letter, No. 877, dated the 23rd April 1897, was issued to the Secretary, Bengal Chamber of Commerce, Calcutta,—a letter of the same tenour, No. 878, dated the 23rd April 1897, being forwarded to the Secretary, Chamber of Commerce, Bombay:—

I have the honour to enclose copy of a letter, dated the 24th March last, from a correspondent, on the subject of Tapioca.

I have to request the favour of your being so good as to furnish me with the desired particulars.

Apologising for the trouble given.

The replies received were as under:—

From John Marshall, Esq., Secretary, Chamber of Commerce, Bombay,—dated Bombay, the 29th April 1897.

I am directed to acknowledge the receipt of your letter No. 878—151 of the 23rd instant.

In reply, I am directed to inform you that, so far as this Chamber has been able to ascertain, there is no export of Tapioca Flour or Roots from Bombay, nor can I learn that there are any factories for the manufacture of Tapioca Flour in India.

From W. Parsons, Esq., Secretary, Bengal Chamber of Commerce,—No. 740—97, dated Calcutta, the 7th May 1897.

I have the honour to acknowledge receipt of your letter No. 877—151, dated 23rd April 1897, enclosing copy of a letter from a correspondent on the subject of Tapioca, and inquiring if I can furnish you with the desired particulars.

I have caused enquiries to be made in this connection, but regret that I have not been able to obtain any information with regard to the systematic cultivation or manufacture of Tapioca in India, other than what is contained in Vol. XXI. of 'The Indian Forester,' where at pages 290—296 will be found an article on "Tapioca Cultivation in Travancore," in which, however, no particulars as to export are given.

Cont. pp. 13-19.

All communications regarding THE AGRICULTURAL LEDGER should be addressed to the Editor, Dr. George Watt, Reporter on Economic Products to the Government of India, Calcutta.

The objects of this publication (as already stated) are to gradually develop and perfect our knowledge of Indian Agricultural and Economic questions. Contributions or corrections and additions will therefore be most welcome.

In order to preserve a necessary relation to the various Departments of Government, contributions will be classified and numbered under certain series. Thus, for example, papers on Veterinary subjects will be registered under the Veterinary Series. Those of more direct Agricultural or Industrial interest will be grouped according as the products dealt with belong to the Vegetable or Animal Kingdom. In a like manner, contributions on Mineral and Metallic subjects will be registered under the Mineral Series.

This sheet and the title-page may be removed when the subject-matter is filed in its proper place, according to the letter and number shown at the bottom of each page.